Operating Systems Laboratory

Lab 4

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Scheduling Schemes

Shortest Job First (SJF)

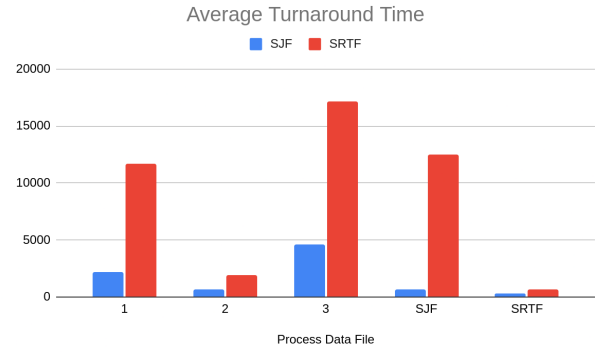
The first scheduling scheme I implemented is the shortest job first or SJF. This is a non-preemptive scheme in which jobs with shorter execution times are run first. Such a scheme tries to minimise the waiting time by finishing shorter jobs first; however, due to its non-preemptive nature, the arrival of a larger job first can stall any shorter jobs which arrive later (called the convoy effect).

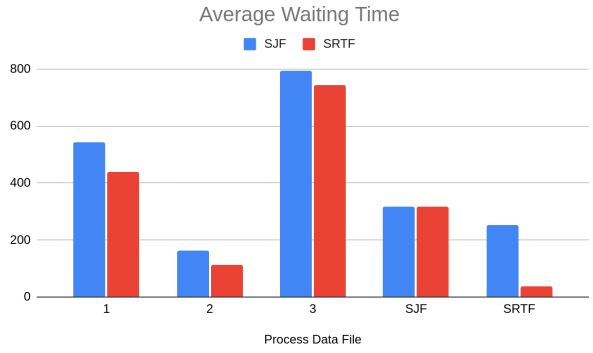
Shortest Remaining Time First (SRTF)

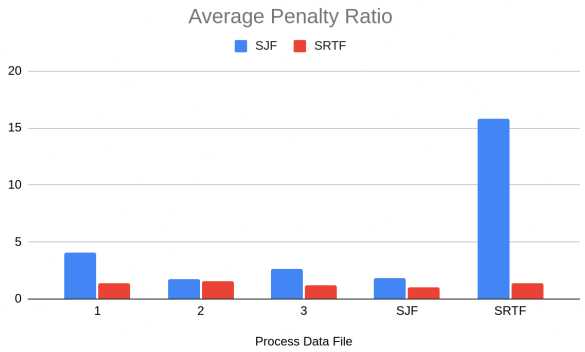
The second scheduling scheme I implemented is the shortest remaining time first or SRTF. This is a preemptive version of SJF. This solves the problem of the convoy effect, minimising the waiting times to the minimum. This also leads to a lower average penalty ratio. However, the preemptive nature leads to an increase in the average turnaround times and average throughput.

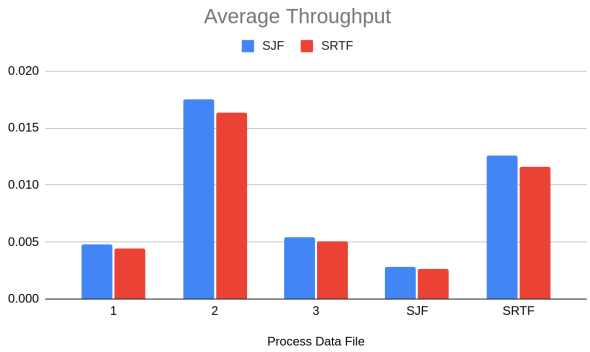
Observations

Comparisons









Raw Tables

Process Data File 1

Process	SJF			SRTF		
	Waiting Time	Turnaround Time	Penalty Ratio	Waiting Time	Turnaround Time	Penalty Ratio
0	803	4097	1.243777	843	32056	1.027008
1	871	4579	1.234897	591	16744	1.036588
2	370	1893	1.242942	300	6270	1.050251
3	349	1454	1.315837	99	1164	1.092958
4	106	308	1.524752	16	38	1.727273
5	97	102	20.4	7	12	2.4
6	1214	2631	1.85674	1214	25257	1.050493
Average	544.285706	2152	4.116992	438.571442	11648.71387	1.340653
Throughput	0.004795			0.004442		

Process Data File 2

Process	SJF			SRTF		
	Waiting Time	Turnaround Time	Penalty Ratio	Waiting Time	Turnaround Time	Penalty Ratio
0	0	5	1	0	5	1
1	121	146	5.84	23	48	1.92
2	320	1148	1.386473	230	3351	1.073694
3	78	213	1.577778	25	57	1.78125
4	472	2305	1.257501	412	9406	1.045808
5	148	441	1.505119	92	267	1.525714
6	597	3878	1.181957	599	19233	1.032146
7	77	210	1.578947	54	120	1.818182
8	192	391	1.964824	122	499	1.323607
9	147	438	1.505155	100	303	1.492611
10	148	441	1.505119	89	258	1.526627
11	116	336	1.527273	24	54	1.8
12	117	339	1.527027	91	234	1.636364
13	103	294	1.539267	65	177	1.580357
14	106	303	1.538071	23	54	1.741935
15	65	174	1.59633	57	153	1.59375
16	67	180	1.59292	23	54	1.741935
17	68	183	1.591304	30	69	1.769231
Average	163.444443	634.722229	1.73417	114.388885	1907.888916	1.522401
Throughput	0.017476			0.016393		

Process Data File 3

Process	SJF			SRTF		
	Waiting Time	Turnaround Time	Penalty Ratio	Waiting Time	Turnaround Time	Penalty Ratio
0	560	6939	1.087788	455	6945	1.070108
1	1778	4938	1.562658	1597	46299	1.035725
2	806	9435	1.093406	611	13120	1.048845
3	1507	4231	1.553231	1317	19502	1.072422
4	322	4755	1.072637	295	4420	1.071515
5	1687	6226	1.371668	1689	57375	1.030331
6	590	5457	1.121225	612	11240	1.057584
7	0	6	1	0	6	1
8	22	42	2.1	17	37	1.85
9	1536	1636	16.360001	1446	14550	1.110348
10	9	19	1.9	9 19		1.9
11	714	11651	1.065283	864	32787	1.027065
Average	794.25	4611.25	2.607325	742.666687	17191.66602	1.189495
Throughput	0.00545			0.005098		

Process Test Data

Favourable for SRTF

```
0 300 -1
3 10 -1
5 30 -1
5 40 -1
8 12 -1
```

In such a process, test data where a large job arrives before several smaller tasks, the average wait time and average penalty ratio for SJF are much larger than SRTF due to the convoy Effect. This is bad because the smaller job would most likely be IO-related processes which need fast response times.

Unfavourable for SRTF

```
0 300 -1
0 400 -1
1 350 -1
```

In such a process, where several large jobs arrive, the average wait time for SJF and SRTF are almost identical, but the average turnaround time for SRTF is much larger than that of SJF, which is a shortcoming of the scheme.

Analysis

As can be seen from the performance of SJF and SRTF schedulers on the given test cases, SJF minimises the average turnaround times, and SRTF minimises the average waiting times. This behaviour is expected as SJF finishes the shortest jobs first; hence the turnaround time is minimised for most jobs leading to a reduced average turnaround time. However, longer jobs spend more time in the waiting state and even short jobs that arrive later spend more time in the waiting state as the scheduler is non-preemptive. In SRTF, the job with the shortest time remaining are run preemptively; hence the waiting time is minimised for even short jobs which arrive later. However, in this scheme, the average turnaround times increase as jobs switch preemptively.